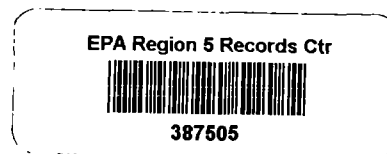


# ENVIRON

November 3, 2003

*Via Electronic Mail*



## MEMORANDUM

To: Dion Novak

From: Ross Jones

Subject: Preliminary Information on Human Health and Screening Level  
Ecological Risk Assessment  
Eagle Zinc Company Site, Hillsboro, Illinois

This memorandum transmits summaries of the methodologies and preliminary information to be used to conduct the human health and screening level ecological risk assessment for the Eagle Zinc Company Site. These materials were initially reviewed during our conference call on October 14, 2003 and modified based on discussions held during the call. To put the attached summaries into context, the following discussion highlights similarities and differences between human health and ecological risk assessments.

Many elements and techniques are common to both human health and the ecological assessments. Although terminology differs, basic steps in the two processes are similar in concept, as shown in the table below:

Human	Ecological
Site Characterization	Problem Formulation
Hazard Identification	Effects Analysis
Dose-Response Assessment	
Exposure Assessment	Exposure Analysis
Risk Characterization	Risk Characterization

However, several key differences between human and ecological risk assessment should be recognized. First, the subject of human health risk assessment is the human individual, but ecological risk assessment may focus on any one or any combination of ecological components. In general, loss of a few individuals of a species is unlikely to significantly diminish the viability of the population or disrupt the community or

ecosystem of which it is a part. As a result, the fundamental unit for ecological risk assessment is generally the population rather than the individual, with the exception of protected (e.g., threatened and endangered) species. Second, human health and ecological risk assessment processes focus on different endpoints (defined as characteristics or functions that may be adversely affected by exposure to site-related chemicals). The endpoints of human health risk assessment are relatively limited and well-defined (e.g., cancer, systemic toxicity, developmental or reproductive effects); the endpoints for ecological risk assessment can be several, including mortality and effects on different species. Thus, due to the many different stressors, habitats, and historical elements that may be a part of, or contribute to, an ecological risk assessment, the process must be flexible while providing logical and scientific structure.

Finally, as mentioned above, ecological risk assessors must be aware of the potential effects of not only chemicals, but also of physical and biological agents on ecological receptors. Physical stressors include global phenomena such as ozone depletion as well as local and regional phenomena such as habitat destruction or alteration by natural events (drought, fire) or human activities (construction, farming), and extremes of natural conditions (e.g., temperature, moisture, water level and flow rate). Potential biological stressors include disease and predation. Although current risk assessment practices focus primarily on chemical stressors, it must be emphasized that physical stressors are likely to be more significant than chemical stressors in areas of human habitation. Thus, ecological risk assessment guidance calls for use of the phrase “stressor-response” rather than “dose-response” to emphasize the possibility that physical conditions can stress ecosystems as well as the presence of chemicals.

FRJ:alb

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# **HHRA Approach for Eagle Zinc Company Site**

## **1.0 INTRODUCTION**

The human health risk assessment for the Eagle Zinc Company Site in Hillsboro, IL (the Site) will evaluate the potential exposure and risks to human health associated with chemicals of potential concern (COPCs) in potential exposure media. This process will be performed in a step-wise manner, in accordance with the Illinois Environmental Protection Agency's (IEPA's) "Tiered Approach to Corrective Action Objectives" (TACO) -- Title 35, Part 742 of the Illinois Administrative Code (IAC), and relevant guidance from the U.S. Environmental Protection Agency (EPA) and other authorities as necessary. TACO is based primarily on assumptions and methods developed by the EPA, and as such is consistent with EPA guidance.

## 2.0 COMPONENTS OF HUMAN HEALTH RISK ASSESSMENT

The human health risk assessment process typically involves five basic elements:

- **Data Review and Evaluation.** Available data are reviewed to characterize the site and its associated constituents, define the nature and magnitude of constituent releases to environmental media and identify site-related COPCs (defined as hazardous constituents clearly associated with the Site that are positively detected at concentrations higher than Tier 1 remediation objectives).
- **Exposure Assessment.** Exposure assessment defines the amount, frequency, duration, and routes of receptor exposure to Site-related COPCs. The exposure assessment considers both current and likely future site uses, and is based on complete exposure pathways to actual or probable human receptors (*i.e.*, the people who could come in contact with site-related COPCs). If a Tier 3 analysis is performed, representative concentrations of COPCs in potential exposure media will be used to estimate exposures to the defined receptor populations under both reasonable maximum exposure (RME) and most likely exposure (MLE) conditions.
- **Toxicity Assessment.** The toxicity assessment serves to (1) identify the nature and degree of toxicity of each COPC, and (2) characterize the dose-response relationship (the relationship between magnitude of exposure and magnitude of adverse health effects) for each COPC. The EPA has developed toxicity criteria for many constituents of concern in human health risk assessment. Two kinds of effects are recognized: (1) non-carcinogenic effects, and (2) carcinogenic effects. The same constituent may exert both kinds of effects.
- **Risk Characterization.** In risk characterization, exposure and toxicity data are combined to estimate the nature and magnitude of potential risks to defined receptor populations. Non-carcinogenic risks to human receptors are quantified by the hazard quotient (HQ), the ratio of COPC concentration in site media to the corresponding non-cancer remediation objective. Carcinogenic risks are quantified by multiplying this ratio by the target cancer risk level assumed in the carcinogenic remediation objective. The EPA has defined the acceptable cancer risk range as one-in-one-million ( $10^{-6}$ ) to one-in-ten-thousand ( $10^{-4}$ ). Under Tier 3 of TACO (Sections 742.900(d) and 742.915(i)), total cancer risks exceeding  $10^{-6}$  are permitted if (1) the presence of sensitive populations, (2) the number of receptors potentially impacted,

(3) the duration of risk at the differing target levels, and (4) the characteristics of the chemicals of concern are accounted for.

- **Uncertainty Analysis.** Like any other form of modeling, risk assessment relies on a set of assumptions and estimates, each of which has some element of uncertainty. Major sources of uncertainty in risk assessment include (1) natural variability (*e.g.*, differences in body weight in a group of people), (2) lack of knowledge about basic physical, chemical, and biological properties and processes (*e.g.*, the affinity of a constituent for soil, its solubility in water), (3) lack of accuracy in the models used to estimate key inputs (*e.g.*, dose-response models), and (4) measurement error. The uncertainty analysis accounts for both variability in and lack of knowledge about measured and estimated parameters, allowing decision makers to better evaluate risk estimates in the context of the assumptions and data used in the assessment.

### **3.0 OVERVIEW OF TIERED APPROACH TO RISK ASSESSMENT AT THE EAGLE ZINC COMPANY SITE**

To ensure that human health and beneficial uses of the environment are protected, the tiered, risk-based approach detailed in IEPA's TACO will be used to (1) identify areas that may require further investigation, and (2) develop appropriate risk-based target levels for affected media. This approach, depicted as a decision tree in Figure 1, follows the standard steps of risk assessment, and is based on EPA-approved methodologies. As shown in Figure 1, the approach consists of three tiers of increasing site-specificity. Depending on site conditions and user preferences, these components may be implemented sequentially, or users may proceed directly to an appropriate tier. These tiers are briefly described below.

#### **3.1 Tier 1** Error! Bookmark not defined.

In Tier 1 of TACO, the exposure scenarios to be considered are residential, commercial/industrial, and construction worker, and affected media to be considered are limited to soil and groundwater. Therefore, the first step in the risk assessment for the Site will be to compare representative concentrations of site-related COPCs in soil and sediment on-Site with TACO Tier 1 soil remediation objectives for the lower of industrial/commercial and construction worker scenarios. For off-Site media, TACO Tier 1 remediation objectives for residential land use will be used. These Tier 1 remediation objectives provided in TACO are defined as constituent concentrations in soil that are protective of human health based on EPA-recommended RME assumptions for residential and worker exposure scenarios and EPA-approved chronic toxicity criteria, with a target cancer risk level of  $10^{-6}$  and a target non-cancer hazard quotient of 1.

The characteristics of the aquifer will be used to classify the groundwater below the Site in accordance with 35 IAC 620. Based on the classification, representative concentrations of COPCs in groundwater will be compared with the appropriate (*i.e.*, either Class I or Class II) Tier 1 remediation objectives.

Because of the conservatism of the Tier 1 remediation objectives, no further action will be considered in areas where representative concentrations of COPCs are below these levels. In areas where Tier 1 criteria are exceeded, but interim corrective action to meet these conservative,

non-site-specific levels is not considered appropriate, Tier 2 assessment may be warranted. The Tier 1 evaluation will identify any areas that require further investigation or remedial action. TACO requires the implementation of institutional controls, in accordance with Subpart J of 35 IAC 742, if remediation objectives are developed based on industrial/commercial property use.

### **3.2 TIER 2**

In Tier 2 of TACO, equations from the EPA's Soil Screening Level (SSL) guidance (EPA 1996) and the American Society for Testing and Materials' (ASTM's) Risk Based Corrective Action (RBCA) standard (ASTM 1995) may be used to calculate Tier 2 remediation objectives, with substitution of site-specific parameter values for certain defaults and use of simple modeling to calculate acceptable COPC concentrations at locations other than that of the receptor. As in Tier 1, Tier 2 evaluates residential and industrial/commercial properties only, and uses a target cancer risk level of  $10^{-6}$  and a target non-cancer hazard quotient of 1.

Parameters whose values that can be altered in Tier 2 include:

- Aquifer thickness
- Depth to source
- Lower depth of surficial soil zone
- Organic carbon content
- Soil pH
- Average soil moisture content
- Hydraulic gradient
- Hydraulic conductivity
- Source length parallel to groundwater flow direction
- Source width perpendicular to groundwater flow direction
- Source width parallel to groundwater flow or wind direction
- Dry soil bulk density
- Soil particle density

No further action will be considered in areas where representative concentrations of COPCs are below Tier 2 remediation objectives. In areas where Tier 2 criteria are exceeded,

interim or final corrective action may be considered. As mentioned previously, TACO requires implementation of institutional controls, in accordance with Subpart J of 35 IAC 742, if remediation objectives are developed based on industrial/commercial property use. If remediation to Tier 2 levels is deemed to be inappropriate or impracticable, then Tier 3 assessment may be warranted.

### **3.3 TIER 3**

A Tier 3 evaluation allows consideration of receptor scenarios other than residential and worker, and use of alternative parameter values and models not available under a Tier 1 or Tier 2 evaluation to develop remediation objectives. As discussed in Section 0, recreational users of off-Site water bodies could come into contact with COPCs. If representative concentrations in off-Site media exceed Tier 1 and Tier 2 remediation objectives, then this scenario will be considered under Tier 3. Other modifications allowed under Tier 3 that may be used in the Site risk assessment include:

- Use of additional site data to improve or confirm predictions of exposed receptors to contaminants of concern;
- Analysis of site-specific risks using formal risk assessment, probabilistic data analysis, and sophisticated fate and transport models (*e.g.*, requesting a target hazard quotient greater than 1 or a target cancer risk greater than  $10^{-6}$ ), provided that the following factors are satisfactorily addressed: (1) the presence of sensitive populations; (2) the number of receptors potentially impacted; (3) the duration of risk at the differing target levels; and (4) the characteristics of the COPCs.
- Requests for site-specific remediation objectives because an assessment indicates further remediation is not practical;
- Incomplete human exposure pathway(s) not excluded under Subpart C of TACO; and
- Use of toxicological information other than that approved by the EPA.



## 4.0 SELECTION OF CHEMICALS OF POTENTIAL CONCERN

The first step of the risk assessment process is an evaluation of all available data to (1) characterize conditions at the Site, (2) develop a data set for use in the assessment, and (3) identify site-related COPCs. Previous documents have summarized site characterization information and described the data set (ENVIRON 2002). COPCs are the focus of the risk assessment process. The following COPC selection criteria will be applied sequentially to the risk assessment data set(s):

- Associated with former Site activities;
- Positively detected in more than 5% of samples; and
- Positively detected in at least one sample at levels above maximum background, if available.

To identify COPCs in on-Site media, the maximum detected chemical concentrations of analytes meeting the criteria above will be screened against relevant TACO Tier 1 remediation objectives for industrial/commercial land use. For off-Site media, TACO Tier 1 remediation objectives for residential land use will be used. Chemicals that were not positively detected in any sample will be eliminated from further consideration. The more stringent of the Tier 1 remediation objectives for soil ingestion or inhalation exposure pathways for industrial and construction worker scenarios will be selected for the comparison. A preliminary list of possible COPCs identified during the Remedial Investigation (ENVIRON 2003a&b) is presented in Table 1.

**Table 1. Summary of Preliminary Chemicals of Potential Concern**

On-Site Soil	Sediment		Groundwater	Surface Water	
	Western Drainageway	Eastern Drainageway		Western Drainageway	Eastern Drainageway
Metals					
Cadmium Zinc	Antimony Arsenic Cadmium Lead Zinc	Cadmium Zinc	Cadmium Lead Manganese Thallium Zinc Iron Sulfate	Cadmium Iron Zinc	Zinc
Organics					
	Vinyl chloride				

## 5.0 EXPOSURE ASSESSMENT

The objective of the exposure assessment is to estimate the magnitude, frequency, duration, and routes of current and reasonably anticipated future human exposure to COPCs associated with the Site. The exposure assessment is based on scenarios that define the conditions of exposure to COPCs. These scenarios are summarized in the exposure pathway conceptual site model (CSM), which represents our current understanding of the sources of COPCs, the means by which they are released and transported within and among media, and the exposure pathways and routes by which they may contact human receptors. The potential magnitude of exposure is determined by measuring or estimating the representative concentrations of COPCs available in various media at "exchange boundaries" (*e.g.*, the lungs, gastrointestinal tract, or skin), and the receptors' frequency and magnitude of exposure to affected media.

Of course, each of the parameters involved in exposure estimation has finite associated uncertainty, variability, or both. Despite recognition of these uncertainties, the typical approach is to assume that input parameters that are in reality complex variables can be accurately represented by single (deterministic) values. To ensure a high degree of confidence that potential risks to human health are not underestimated, upper-bound values are used for most risk parameters to create the RME exposure estimate (defined as an estimate that is above the 90<sup>th</sup> percentile but below the 98<sup>th</sup> percentile of the distribution of actual exposures) (EPA 1989). While the RME approach alone satisfies the requirement for protectiveness, it provides (1) no insight into the sources and magnitude of underlying uncertainties, (2) no indication of where calculated risks may fall in the distribution of actual risks, (3) no context for interpretation of results that exceed the conservative deterministic criteria, and (4) no means for determining the cost-effectiveness of various remedial alternatives. In response to these concerns, EPA guidance prescribes use of "multiple descriptors of risk" (EPA 1992b) to provide risk managers with a quantitative sense of the uncertainties inherent in the process. Accordingly, this risk assessment will also evaluate MLE exposure conditions as warranted in an effort to define the central tendency of exposure and risk.

## **5.1 Exposure Pathway Conceptual Site Model**

The objective of exposure assessment is to estimate the potential magnitude, frequency, duration, and routes of human and ecological exposure to site-related constituents. These scenarios are summarized in the CSM for the Site (

Figure 2). This model represents our current understanding of the sources of COPCs, the means by which they are released and transported within and among media, and the exposure pathways and routes by which they may contact identified human and ecological receptors. Thus, the CSM provides the framework for the development of remedial objectives for each COPC, exposure pathway, and receptor. As shown in

Figure 2, the CSM includes:

- Known or potential sources of COPCs;
- Environmental media that may be affected by site-related COPCs, including surface and ground water, soil, sediment, air, and biota;
- Primary and secondary release mechanisms that may be associated with each affected medium;
- Potential exposure pathways for defined receptors, based on collected data or expected pathways; and
- Potential human receptor populations.

A brief discussion of the components of the CSM is presented in the following sections.

### **5.1.1 Sources**

Historical industrial activities at the Site are assumed to be the sources of chemicals present in residue piles, soil, sediment, groundwater, and surface water.

### 5.1.2 Potential Migration Pathways

*Other COPCs based on  
pH 2 & add'l sampling*

With the exception of vinyl chloride in drainageway sediments, the preliminary COPCs in Site media are metals. The concentration and distribution of COPCs in Site media are most likely affected by one or more of the following general mechanisms:

- Suspension and transport of soil particles in air;
- Suspension and transport of soil particles in surface water runoff;
- Desorption of COPCs from subsurface soil particles and leaching into underlying groundwater;
- Migration of dissolved COPCs in groundwater; and
- Groundwater-to-surface water transport of COPCs.

### 5.1.3 Potential Receptor Populations

Potential human receptor populations may include:

- On-site residents (future);
- On-site workers (present and future);
- On-site construction workers (future);
- On-site trespassers (present and future);
- Off-site residents (present and future); and
- Off-site recreational use of Lake Hillsboro and an unnamed tributary to Mid-Fork Shoal Creek (present and future).

Because the Site's current and historical use is industrial and current zoning does not permit residential development, the assumption that future land use at the Site will be industrial is considered valid. Accordingly, the most appropriate on-Site exposure scenario is the commercial/industrial worker. The construction worker exposure has also been evaluated to ensure that remediation objectives based on the industrial worker are also protective of the construction worker, per Section 742.605 of TACO. Although trespassers could access the Site, the magnitude of their exposure would be much less than that experienced by workers. Accordingly, this scenario will not be considered in the risk assessment.

*What are Cities  
long term plans  
in zoning*

*Why  
not  
risk #1's  
needed*

#### 5.1.4 Potentially Complete Exposure Pathways

A human exposure pathway is defined in TACO as “a physical condition which may allow for a risk to human health based on the presence of all of the following: contaminants of concern; an exposure route; and a receptor activity at the point of exposure that could result in contaminant of concern intake.” If any of these components is missing, then the pathway is incomplete and does not contribute to receptor exposure. The rationale for selection of potentially complete exposure pathways is briefly discussed below and summarized in Table 2.

COPCs are present in residue piles, soils, surface water, sediments, and groundwater at the Site. Direct exposure of on-Site commercial/industrial workers to COPCs in soil via incidental ingestion, inhalation of airborne particles, and dermal contact is therefore possible. Construction workers could also be exposed to COPCs in soil via these direct exposure routes. The potable water supply to the Site is provided by the city, and groundwater resources are not expected to be developed for potable purposes in the future. Therefore, there are no complete exposure pathways associated with groundwater for on-Site receptors. GW → SW

## 5.2 Calculating Representative Concentrations

Representative concentrations of COPCs can be estimated using a combination of techniques. Left-censored data sets (*i.e.*, those containing a significant number of non-detects) may be analyzed using one-half the detection limit for the non-detects or standard uncensoring mathematical techniques (EPA 1992a). Due to the uncertainty associated with any estimate of exposure concentration, both the sample mean and the one-sided upper 95% confidence limit of the sample mean (95% UCL) of the data may be calculated to represent a reasonable range of potential exposure concentrations in the risk assessment. EPA considers the 95% UCL to be a reasonable maximum estimate (RME) of the average COPC concentration likely to be contacted over time; the sample mean constitutes a conservative maximum likelihood estimate (MLE) of the central tendency exposure concentration (EPA 1992a, 1992c, 2002).

Calculation of representative concentrations of COPCs requires determination of their statistical distribution type. An appropriate normality test will be performed for each COPC. After the distributions of the data sets have been determined, appropriate statistical techniques

will be selected to determine the representative concentrations of each COPC. The statistical techniques that will be evaluated include, *inter alia*, the Student's *t*-Statistic, the MVUE, bootstrap resampling, or the Jackknife (EPA 1992c, 1997c, 2002). A final selection of the most appropriate statistical technique will only be made after a thorough examination of each data set.

## 6.0 TOXICITY ASSESSMENT

The toxicity assessment characterizes the relationship between the magnitude of exposure to a COPC and the nature and magnitude of adverse health effects that may result from such exposure. Toxicity criteria for use in risk assessment may be based on epidemiological studies, short-term human studies, or subchronic or chronic animal data. Toxicity criteria for COPCs at the Site will be selected (in order of preference) from the following sources: (1) EPA's *Integrated Risk Information System* (IRIS) (EPA 2003b); (2) EPA's *Health Effects Assessment Summary Tables* (HEAST) (EPA 1997a); (3) EPA-NCEA Superfund Health Risk Technical Support Center; or (4) extrapolated from the oral to the inhalation exposure route. IRIS is the official repository of agency-wide consensus human-health information. Although values from HEAST are supported by Agency reference, they are not necessarily Agency-wide consensus values. Thus, toxicity values obtained from IRIS are given priority over those from HEAST, as recommended by EPA (1989). Available subchronic non-cancer toxicity values will be used for the construction worker scenario.

Chemical toxicity is divided into two categories based on the type of adverse health effect exerted for purposes of human health risk assessment: carcinogenic and non-carcinogenic. Potential health risks are calculated differently for these two types of effects because their toxicity criteria are based on different mechanistic assumptions and expressed in different units. In its detailed evaluation of recent data, the EPA (1997b) has found that "EPA's standard assumptions (i.e., 70 kg body weight, 20 m<sup>3</sup>/day air inhaled, and 2 L/day water intake) are inaccurate for the national population...." Because updated values were used to more accurately characterize receptors, certain correction factors may be needed to ensure compatibility with the older assumptions used for the same characteristics to create EPA's toxicological criteria. Any such instances will be fully documented in the risk assessment.

### 6.1 Toxicity Indicators for Non-Carcinogenic Effects

A non-carcinogenic effect is defined as any adverse response to a chemical that is not cancer. Any chemical can cause adverse health effects if given at a high enough dose. When the dose is sufficiently low, no adverse effect is observed. Thus, in characterizing the non-cancer effects of a chemical, the key parameter is the threshold dose at which an adverse effect first

becomes evident. Doses below the threshold are considered to be "safe" (*i.e.*, not associated with adverse effects), while doses above the threshold may cause an adverse effect.

The threshold dose is typically estimated from toxicological data (derived from studies of humans and/or animals) by finding the highest dose that does not produce an observable adverse effect (the "No-Observed-Adverse-Effect-Level [NOAEL]) and the lowest dose at which an adverse effect is observed (the "Lowest-Observed-Adverse-Effect-Level [LOAEL]). The threshold dose is presumed to lie in the interval between the NOAEL and the LOAEL. In order to be conservative or protective of particularly sensitive potential receptors, non-cancer risk evaluations are not based directly on the threshold exposure level, but on a value referred to as the Reference Dose (RfD).

The RfD is an estimate of the daily lifetime exposure level to humans (expressed in units of mg of chemical/kg of body weight/day), including sensitive subgroups, that is likely to be without appreciable risk of deleterious effects (EPA 1989). RfDs are usually derived from NOAELs (or LOAELs, if reliable NOAELs are not available) from oral exposure studies in the most sensitive species, strain and sex of experimental animal known, the assumption being that humans are no less sensitive than the most sensitive animal species tested. The RfDs incorporate a series of uncertainty factors representing inter- and intraspecies variability and the quality and completeness of the toxicological database. These uncertainty factors (with one exception) are assigned a value of at least 10. If human studies are available and the observations considered reliable, the uncertainty factor may be as small as 1. The effect of dividing the NOAEL or the LOAEL by the product of all the uncertainty factors is to ensure that the RfD is not higher than the threshold level for adverse effects in the most sensitive potential receptor. Thus, there is a "margin of safety" built into a RfD, and doses equal to or less than the RfD are nearly certain to be without any adverse effect. The likelihood of an adverse effect at doses higher than the RfD increases, but because of the margin of safety, a dose above the RfD does not mean that such an effect will necessarily occur.

## **6.2 Toxicity Indicators for Carcinogenic Effects**

Cancers are generally defined as diseases of mutation affecting cell growth and differentiation. In contrast to non-carcinogenic effects, EPA traditionally assumes that there is no threshold for carcinogenic responses; that is, any dose of a carcinogen is considered to pose



some finite risk of cancer. The evidence for human carcinogenicity of a chemical is derived from two sources: chronic studies with laboratory animals and human epidemiology studies where an increased incidence of cancer is associated with exposure to the chemical. The EPA typically assumes that negative epidemiological data are not evidence that a chemical is not carcinogenic in humans.

Since risks at the low levels of exposure usually encountered by humans are difficult to quantify directly by either animal or epidemiological studies, mathematical models are used to extrapolate from high experimental to low environmental doses. The slope of the extrapolated dose-response curve is used to calculate the cancer slope factor (SF), which defines the incremental lifetime cancer risk per unit of carcinogen (in units of risk per mg/kg/day). The linearized multi-stage model for low-dose extrapolation most often used by EPA (EPA 1986, 2003a) is one of the most conservative available, and leads to a upper-bound estimate of risk (the upper 95% confidence limit on the modeled animal dose-response slope). Under the assumption of dose-response linearity at low doses, the probability that the true potency is higher than that estimated is thus only 5 percent. Actual potency (and resultant risk) is likely to be lower, and could even be zero (EPA 1986). Recent guidance provides for derivation of dose-response relationship using alternative low-dose-response extrapolation procedures as indicated by the nature and quality of the database (EPA 2003a).

### **6.3 Lead**

The EPA has deemed it inappropriate to develop either an RfD or a SF for inorganic lead. A great deal of information on the health effects of lead has been obtained over the past 60 years of medical observation and scientific research. Inorganic lead may be absorbed by inhalation or by ingestion. Absorption by either route contributes in an additive fashion to the total body burden. Infants are born with a lead burden (lead present in their body) that primarily reflects the mothers' past exposure. Infants and children are exposed to lead mainly from ingestion of food and beverages and the ingestion of non-food materials by normal early mouthing behavior. The impact that the mouthing behavior has on the blood lead level depends on the levels of lead in house dust, soil, and paint. Most adults are exposed to lead primarily from dietary sources (food and water), but occupational exposure to lead may be significant in some circumstances.

Instead of dose-based toxicity criteria, potential risk associated with lead exposure is assessed by means of blood lead levels. The EPA has established a target blood lead level for children less than eight years of age, who are particularly susceptible to lead toxicity, of no more than 10 µg/dL for both short- and long-term exposures. This level is based on the occurrence of enzymatic alterations in erythrocytes at blood lead levels below 25 µg/dL and by reports of neurologic and cognitive dysfunction in children at blood lead levels between 10 and 15 µg/dL (ATSDR 1997). Using an integrated exposure uptake-biokinetic (IEUBK) model that is specifically designed to predict blood lead levels, a lead concentration in soil at which there is no more than a 5 percent chance that exposure would result in exceedance of the target blood lead level for children (10 µg/dL) can be derived (EPA 1994).

Due to the significant behavioral and physiological differences between children and adults, the IEUBK model does not allow estimation of blood lead levels for persons older than eight years of age or for less than 350 days/year exposure frequency (EPA 1994). For adults, the EPA has developed an approach to assessing lead hazards to the fetuses of pregnant women exposed to lead in soil under non-residential exposure conditions (EPA 1999, 2003c). This model, which permits calculation of soil concentrations of lead corresponding to a projected target blood lead concentration of 10 µg/dL in fetuses, will be used to calculate lead screening levels for Site soils.

## 7.0 RISK CHARACTERIZATION

Risk characterization involves estimating the magnitude of the potential adverse health effects of the hazardous constituents under study and making summary judgments about the nature of the health threat to the defined receptor populations. It combines the results of the dose-response (toxicity) and exposure assessments to provide numerical estimates of health risk. Risk characterization also considers the nature and weight of evidence supporting these risk estimates as well as the magnitude of uncertainty surrounding such estimates.

### 7.1 Tier 1 Risk Characterization

In the Tier 1 risk characterization, Tier 1 remediation objectives for each COPC and medium will be compared with representative concentrations in corresponding media to calculate screening level hazard quotients (SLHQs) for non-carcinogenic effects and screening level cancer risks (SLCRs) for carcinogenic effects.

#### 7.1.1 Calculation of Screening-Level Hazard Quotients and Indices

The degree of exceedance of non-cancer thresholds will be estimated by calculating the ratio of COPC concentration in an exposure medium to the corresponding remediation objective. In a Tier 1 analysis, this ratio is termed a screening-level hazard quotient (SLHQ):

$$\text{SLHQ} = \frac{\text{Representative Concentration}_{\text{COPC/Medium}}}{\text{Tier 1 Remediation Objective}}$$

SLHQs for each COPC/medium/receptor/pathway will be summed to derive non-carcinogenic screening level hazard indices (SLHIs) for each exposure pathway in each receptor scenario:

$$\text{SLHI} = \sum \frac{\text{Representative Concentration}_{\text{COPC/Medium}}}{\text{Tier 1 Remediation Objective}}$$

If the SLHI calculated from the preceding equation exceeds 1, then chemicals will be grouped according to target organs or effects, and the SLHIs will be recalculated.

#### 7.1.2 Calculation of Screening-Level Cancer Risks

Screening-level cancer risks (SLCRs) for each receptor/pathway will be calculated as:

$$\text{SLCR} = \frac{\text{Representative Concentration}_{\text{COPC/Medium}}}{\text{Tier 1 Remediation Objective}} \times \text{Target Risk Level}$$

SLCRs will be summed to calculate a total screening level cancer risk for each receptor/pathway:

$$\text{SLCR} = \sum \frac{\text{Representative Concentration}_{\text{COPC/Medium}}}{\text{Tier 1 Remediation Objective}} \times \text{Target Risk Level}$$

As mentioned previously, the target cumulative incremental cancer risk in Tier 1 is  $10^{-6}$ .

Because of their conservatism, Tier 1 criteria are useful for screening purposes but do not necessarily provide a realistic representation of potential risks. Thus, risks will be considered negligible for pathways where cumulative screening-level cancer risk is less than or equal to  $10^{-6}$ , and the screening-level non-cancer target hazard index is less than or equal to 1. Such areas will accordingly be eliminated from further consideration. In cases where the target levels are exceeded, Tier 2 risk assessment will be performed in order to develop more realistic, site-specific risk estimates to support decision-making.

## 7.2 Tier 2 And Tier 3 Risk Characterization

Tier 2 and Tier 3 remediation objectives will be compared with site data in the manner described above for Tier 1 remediation objectives. As in Tier 1, if media concentrations are less than or equal to Tier 2 or Tier 3 remediation objectives, then no further action need be taken. A confirmation monitoring program may be implemented if required. If media concentrations exceed the Tier 2 levels and remediation to these levels is judged impracticable, then Tier 3 assessment may be undertaken. If media concentrations exceed the Tier 2 levels but Tier 3 evaluation is judged unnecessary or impracticable, or if Tier 3 remediation objectives are exceeded, then alternatives for achievement of target levels will be evaluated.

## 8.0 UNCERTAINTY ANALYSIS

Like all modeling efforts, the risk assessment process relies on a set of assumptions and estimates with varying degrees of accuracy and validity. Major sources of uncertainty in risk assessment include (1) natural variability (*e.g.*, differences in body weight in a group of people), (2) lack of knowledge about basic physical, chemical, and biological properties and processes (*e.g.*, the affinity of a hazardous constituent for soil, its solubility in water), (3) assumptions in the models used to estimate key inputs (*e.g.*, dose-response models), and (4) measurement error. Perhaps the greatest single source of uncertainty in risk-based assessment is the hazardous constituents' dose-response relationships, particularly carcinogenic slope factors. Much uncertainty is also associated with analytical data, which are subject to both systematic error (bias) and random error (imprecision). Other major sources of uncertainty include the COPC identification process, computation of exposure point concentrations using conservative fate and transport assumptions, selection of exposure pathways, and estimation of intake via default exposure assumptions. These and other sources of uncertainty and their anticipated effect on estimated risks will be discussed in detail in this section of the risk assessment.

## 9.0 REFERENCES

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- American Society for Testing and Materials (ASTM). 1995. *Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites*. E 1739-95.
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- \_\_\_\_\_. 2003b. Integrated Risk Information System (IRIS), electronic database.
- \_\_\_\_\_. 2003c. *Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil*. Technical Review Workgroup for Lead. EPA/540/R-03/001. OSWER Directive #9285.7-54. Final.

**Table 2. Summary of Potentially Complete Exposure Pathways to be Considered in the Tier 1 Risk Assessment for the Eagle Zinc Company Site, Hillsboro IL**

Receptor Scenario	Potential Exposure Medium	Potential Exposure Route	Pathway Considered Complete?	Rationale/Comment
On-Site Resident	Groundwater	Potable use	No	Historical use and current zoning of the Site is industrial and City of Hillsboro officials have indicated that there are currently no plans to re-zone the property for other uses <sup>1</sup> . Therefore, residential development is not a reasonably anticipated future land use
	Surface soil	Vapor inhalation Particle inhalation		
	Subsurface soil	Ingestion Dermal contact		
On-Site Industrial Worker	Groundwater	Potable use	No	Site groundwater is not a current or potential source of potable water.
	Surface soil	Vapor inhalation Particle inhalation Ingestion Dermal contact	Yes	Workers could come into contact with surface soil. Accordingly, exposure via ingestion, inhalation, and dermal contact will be evaluated. The only volatile COPC in on-Site media is vinyl chloride in drainageway sediments.
	Subsurface soil	Vapor inhalation Particle inhalation Ingestion Dermal contact	No	Workers would not contact subsurface soil under reasonably foreseeable conditions.
On-Site Construction Worker	Groundwater	Potable use	No	Site groundwater is not a current or potential source of potable water.
		Dermal contact	No	Construction workers could contact groundwater while excavating. However, dermal uptake of groundwater COPCs (metals) is expected to be negligible. <i>why?</i>
	Subsurface soil	Vapor inhalation Particle inhalation	Yes	Construction workers could contact subsurface soil during excavation activities. Accordingly, exposure via ingestion, inhalation, and dermal contact will be evaluated. The only volatile COPC in on-Site media is vinyl chloride in drainageway sediments.
	Surface soil	Ingestion Dermal contact		
Off-Site Resident	Groundwater	Potable use	No	Potable water in this area is supplied by the City. Further, the low yield of the affected aquifer makes its development as a water source unlikely. <i>area wells from city</i>
	Surface soil	Particle inhalation Ingestion Dermal contact	No	Off-site migration of affected surface soil does not appear to have occurred. Therefore, this potential exposure pathway is not complete. <i>dust from piles - ? cumulative exposure</i>
	Surface water	Potable use	Yes	Lake Hillsboro is used as a local drinking water source. Although the intake is distant from the point of confluence with water bodies affected by the Site, this potential pathway will be evaluated to ensure that drinking water quality will not be impacted <sup>2</sup> .
Off-Site Recreational User	Surface water	Ingestion Dermal contact	Yes	Surface water runoff from the Site ultimately discharges to an unnamed tributary to Mid-Fork Shoal Creek and Lake Hillsboro. Recreational users wading or swimming in these water bodies could be exposed to chemicals, if present, in surface water and sediment <sup>3</sup> .
	Sediment	Ingestion	Yes	
		Dermal contact	No	Exposure to COPCs via dermal contact with sediment is considered to be negligible.

<sup>1</sup> The City has long-term plans to incorporate the Site into the City limits, to obtain ownership of the property, and to redevelop the property for commercial/industrial use.

<sup>2</sup> It is noted that no COPCs were detected above screening levels in surface water in the Eastern Drainageway immediately upstream of its confluence with Lake Hillsboro.

<sup>3</sup> It is noted that (1) no COPCs were detected above screening levels in surface water in the Eastern Drainageway immediately upstream of its confluence with Lake Hillsboro or within the unnamed tributary to Mid-Fork Shoal Creek, and (2) no COPCs were detected in sediments above screening levels for direct-contact pathways in the Eastern Drainageway or in the unnamed tributary to Mid-Fork Shoal Creek.



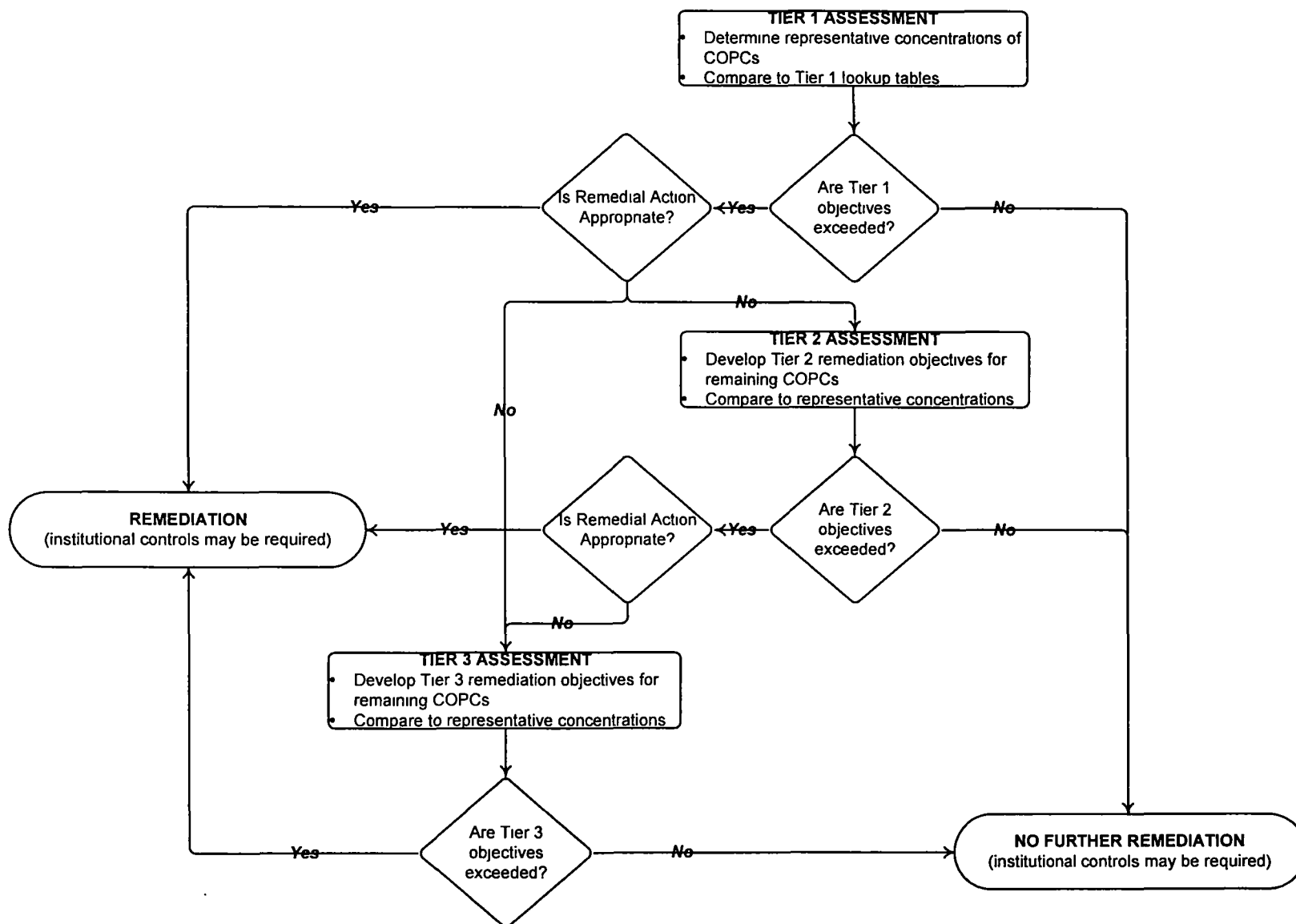
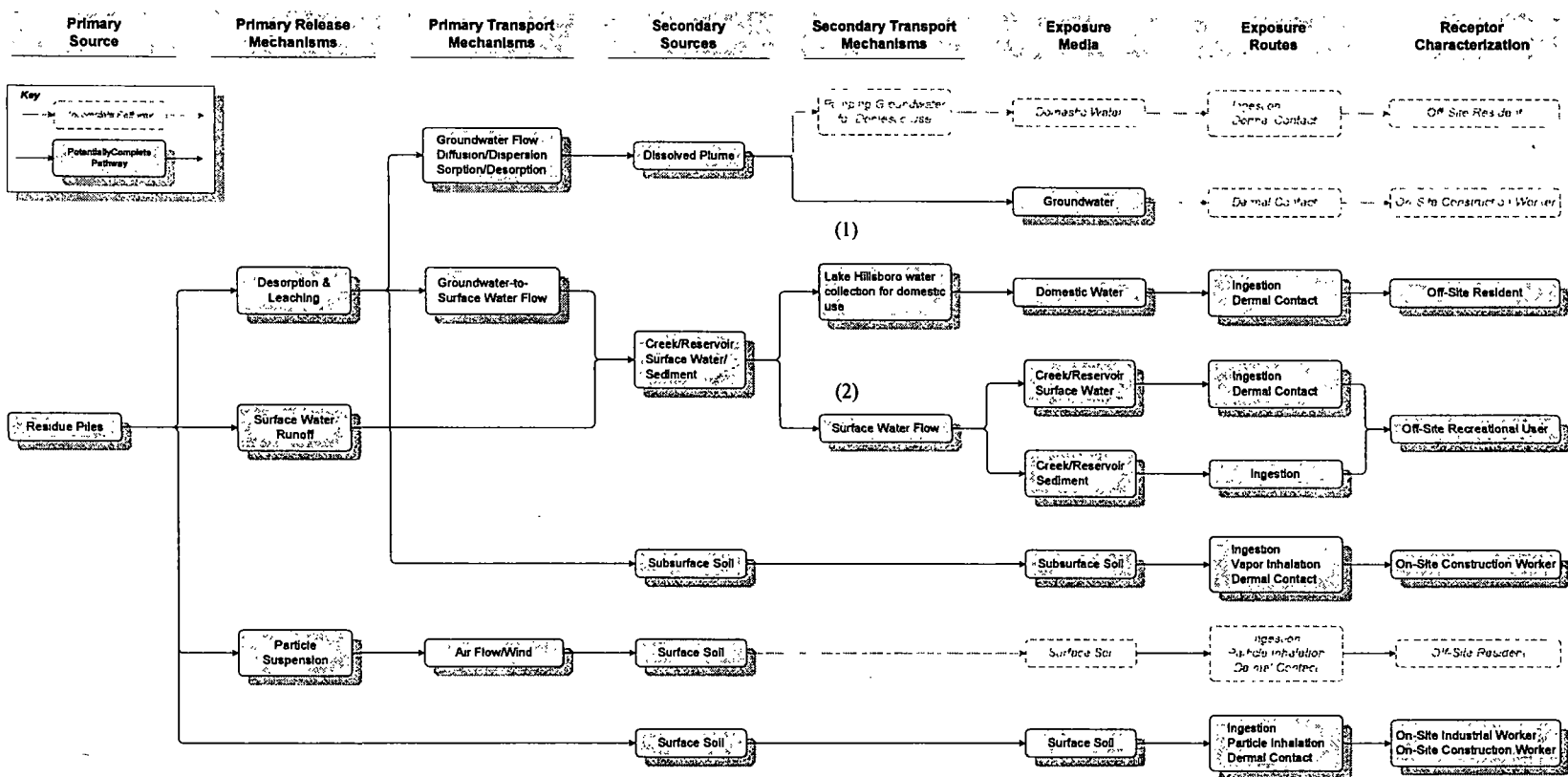


Figure 1. Conceptual Decision Tree Under IEPA's Tiered Approach to Corrective Action (TACO)



**Notes:**

(1) Although the intake is distant from the point of confluence with water bodies affected by the Site, this potential pathway will be evaluated to ensure that drinking water quality will not be impacted. It is noted that no COPCs were detected above screening levels in surface water in the Eastern Drainageway immediately upstream of its confluence with Lake Hillsboro.

(2) It is noted that: 1) no COPCs were detected above screening levels in surface water in the Eastern Drainageway immediately upstream of its confluence with Lake Hillsboro or within the unnamed tributary to Mid-Fork Shoal Creek; and 2) no COPCs were detected in sediments above screening levels for direct-contact exposure pathways in the Eastern Drainageway or in the unnamed tributary to Mid-Fork Shoal Creek.

**Figure 2. Preliminary Exposure Pathway Conceptual Site Model for the Eagle Zinc Company Site, Hillsboro, IL**



## Limno-Tech, Inc.

Excellence in Environmental Solutions Since 1975

### Memorandum

DATE: October 27, 2003  
PROJECT: EAGLE

TO: Ross Jones  
ENVIRON

FROM: John Wolfe  
Wendy Larson

SUBJECT: SLERA Approach for Eagle Zinc Company Site

This memo describes the proposed approach for a screening level ecological risk assessment (SLERA) for the Eagle Zinc Company site in Hillsboro, Illinois. The primary purpose of this SLERA is to identify potentially complete exposure pathways and preliminary chemicals of potential concern (COPC) for the baseline ecological risk assessment by eliminating those chemicals and exposure pathways that pose negligible risks.

Ecological risk assessors must be aware of the potential effects of not only chemicals, but also of physical and biological agents on ecological receptors. Physical stressors include local and regional phenomena such as habitat destruction or alteration by natural events (drought, fire) or human activities (construction, farming), and extremes of natural conditions (e.g., temperature, moisture, water level and flow rate). Potential biological stressors include disease and predation. Although current risk assessment practices focus primarily on chemical stressors, it must be emphasized that physical stressors may be more significant than chemical stressors in areas of human habitation. Thus, ecological risk assessment guidance calls for use of the phrase "stressor-response" rather than "dose-response" to emphasize the possibility that physical conditions can stress ecosystems as well as the presence of chemicals.

The general methods to be used in this SLERA follow Steps 1 and 2 of the U.S. EPA guidelines for conducting ecological risk assessments at Superfund Sites (U.S. EPA 1997): (1) screening-level problem formulation and ecological effects evaluation, and (2) screening-level exposure estimate and risk calculation, and ASTM's *Standard Guide for Risk-Based Corrective Action for Protection of Ecological Resources* (ASTM 2002).

#### Screening-Level Problem Formulation and Ecological Effects Evaluation

Because there is often a wide range of potential ecological effects at sites containing hazardous chemicals or other stressors, it is important to adequately define the scope and focus of the SLERA at the outset. Screening-level problem formulation includes stressor characterization, identification of chemicals of potential concern (COPCs) and relevant ecological receptors of concern (ROCs), selection of assessment endpoints and measures of exposure and effects, and development of an exposure pathway site conceptual model. A key element of the screening-level problem formulation is completion of an environmental checklist that organizes and summarizes available information on site conditions.

Historical and current operations at the Site are described in a Preliminary Site Evaluation (PSE) Report, which was submitted to the USEPA Region V and Illinois EPA in March 2002 (Environ, 2002). Zinc processing operations began at the Eagle Zinc Site in 1912. Smelting products included zinc and sulfuric acid. In 1919, the Site was purchased by Eagle Picher Industries, which continued zinc smelting and manufactured sulfuric acid. Sometime after 1919, zinc oxide and leaded zinc oxide production commenced at the site. The leaded zinc oxide production ceased around 1958, however, Eagle Picher continued to manufacture zinc oxide at the site until November 1980. At that time, Sherwin-Williams purchased the Site and conducted manufacturing operations for less than one year. In 1984 the facility was sold to Eagle Zinc Company. Eagle Zinc predominantly manufactured zinc oxide at the Site. Manufacturing operations permanently ceased at the end of 2002 (Environ, 2003a).

These intensive industrial land uses on the site and in the general vicinity for the past approximately 90 years have resulted in significant physical disturbances to habitats, as described in Section 11 of the attached checklist (Attachment A) and shown in the attached aerial photo. Approximately 10-15% of the site is covered by buildings (Environ, 2002). Other site features include railroad spurs, raw material and residual material stockpiles (in open areas covering approximately 20-25% of the site), and several paved and unpaved roadways.

Chemistry data for water, sediment, and soils are available for various on and off-site locations (Environ, 2003a and b). The major classes of chemicals that have been analyzed for include metals, polychlorinated biphenyls (PCBs), volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs). Many of the compounds analyzed were not measured above the detection level. Metals were detected at some locations, as well as some organic compounds. PCBs were not detected in any of the surface water, sediment or soil samples.

A site visit was conducted on July 15, 2002 to characterize the ecological setting, and identify potentially complete exposure pathways and measurement endpoints. Based on this visit and a review of available background documents, a checklist was prepared (Attachment A), with a map of key ecological features of the site an accompanying list of species observed during the site visit, and correspondence on threatened and endangered species. An exposure pathway CSM for the site was then developed (Attachment B) based on information collected during the site visit and a review of available documents, consistent with ASTM (2002). This model depicts the transport of COPCs from impacted source media to exposure media and relevant ROCs. Identified relevant ROCs are aquatic biota (pelagic and sediment) and wading birds and piscivorous mammals in offsite receiving waters. Onsite receptors were not identified as relevant because habitat requirements were not determined to be consistent with past, current or future uses.

The site property is currently zoned for heavy industrial use and local officials have indicated to ENVIRON that there are currently no plans to re-zone the property for other uses. Furthermore, according to the Mayor of Hillsboro, Hon. William Baran and the

Chairperson of the Planning Committee, Tom Gooding, the City has long term plans (following appropriate environmental mitigation) to incorporate the site into the City limits, to obtain ownership of the property, and to redevelop the property for commercial/industrial use. The scenario envisioned by City officials includes an industrial park predominantly consisting of warehouses, potentially with some light industry. Development of a Master Plan for the entire City has been initiated, which will include the future redevelopment of the site as a major component.

For the screening-level ecological risk assessment, assessment endpoints include any likely adverse ecological effects on receptors for which exposure pathways are complete. Measurement endpoints will be based on the available literature regarding mechanisms of toxicity and are used to establish the screening ecotoxicity values. Surface water screening ecotoxicity values are general use water quality standards in Title 35 of the Illinois Administrative Code, where available. These water quality criteria (WQC) are analogous to national water quality criteria that are designed to protect 95 percent of the species in a generic aquatic community. If Illinois WQC are not available, U.S. EPA national recommended WQCs (U.S. EPA, 2002) will be used. The lowest value (typically the chronic value for aquatic life) will be selected as the screening threshold for this SLERA.

Illinois does not currently have sediment quality values available for assessing sediment impacts from chemicals to aquatic life. However, generic sediment quality guidelines for freshwater systems are available. Exposure concentrations will be compared to Ontario's *Guidelines for the Protection and Management of Aquatic Sediment Quality* (Persaud, et al., 1993). The thresholds are biologically-based guidelines that have been derived to protect those organisms that are directly impacted by contaminated sediment, namely the sediment-dwelling (benthic) species. These are widely accepted guidelines for ecological screening assessments.

### **Screening-Level Exposure Estimate and Risk Calculation**

In this step, conservative (maximum) estimates of exposure are compared to the screening ecotoxicity values identified above. Offsite receiving waters are defined as the unnamed tributary to Middle Fork Shoal Creek located west of the site and Lake Hillsboro to the east. Surface water and sediment chemistry data are available for the tributary to Middle Fork Shoal Creek, through the Phase 2 efforts conducted by Environ (2003b). The major classes of chemicals that have been measured include metals, polychlorinated biphenyls (PCBs), volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs). Maximum concentrations will be used to characterize exposures.

Tissue data are not currently available, so exposures to wading birds and piscivorous mammals through tissue ingestion cannot be quantified, and the risk characterizations for surface water and sediments will serve as proxies for ecological risk due to tissue ingestion. For Lake Hillsboro, a simple dilution analysis will be conducted to estimate the

concentration of identified chemicals of potential concern in lake water attributable to loads via runoff from the site.

The screening-level risk characterization compares screening ecotoxicity values with maximum exposure concentrations to assess whether chemical concentrations are sufficiently high to pose unacceptable risks to ecological receptors. Potential risks to aquatic and terrestrial life will be characterized by computing hazard quotients (HQs) for each chemical/receptor pair. An HQ is the ratio of the concentration in the site media over the appropriate screening threshold. An HQ less than 1.0 suggests that the chemical may be present at a sufficiently high concentration to adversely affect communities, and should be assessed further. An HQ less than 1.0 suggests negligible risks to the community.

Based on the results of the screening-level ecological risk calculation, the risk assessor and risk manager will determine whether or not contaminants from the site pose an ecological threat. If there are sufficient data to determine that ecological threats are negligible, the ecological risk assessment will be complete at this step with a finding of negligible ecological risk. If the data indicate that there is (or might be) a risk of adverse ecological effects, the ecological risk assessment process will continue. Because conservative assumptions have been used for each step of the SLERA, HQs greater than one do not necessarily indicate that cleanup is required; indeed, USEPA guidance states that “requiring a cleanup based solely on this information would not be technically defensible” (USEPA 1997).

## References

- ASTM International, 2002. Standard Guide for Risk-Based Corrective Action for Protection of Ecological Resources. Designation: E2205-02. West Conshohocken, PA.
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- ENVIRON International Corporation, 2003a. Technical Memorandum Remedial Investigation Phase I: Source Characterization, Remedial Investigation/Feasibility Study Eagle Zinc Company Site, Hillsboro, Illinois. Submitted to US Environmental Protection Agency, Region V and Illinois Environmental Protection Agency on behalf of Eagle Zinc Group.
- ENVIRON International Corporation, 2003b. Technical Memorandum Remedial Investigation Phase 2: Migration Pathway Assessment. Remedial Investigation/Feasibility Study. Eagle Zinc Company Site, Hillsboro, Illinois. Submitted to US Environmental Protection Agency, Region V and Illinois Environmental Protection Agency on behalf of Eagle Zinc Group Parties.

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## Check Sheet for Ecological Description of Eagle Zinc Site

### Setting

1 What are the land uses/facilities in the vicinity of the site?

General area is characterized by intensive land use with many industrial facilities, as follows:

North small facility, Hayes Abrasives; golf course; farm fields  
 South small commercial/industrial facilities (Univ. of IL Extension office; Fuller Brothers Construction/Ready Mix; Hixson Lumber, Hillsboro Rental; Vogel Plumbing  
 East Industrial Drive; an asphalt company; a railroad corridor; former Hillsboro Glass Company facility (now a steel warehouse)  
 West Some undeveloped land and a residential area containing single- and multi-family dwellings

What directions do contaminant gradients follow?

Surface water, sediment, soil: Drainageways drain to southwest and northeast, following site topography (see map)

Ground water: Ground water flows generally follows topography, with flow generally towards the southwest in the western part of the site and towards the east and southeast in the eastern part of the site. Limited radial flow in northward direction.

2 What is the site's highest elevation? 637 feet

What is the site's lowest elevation? 600 feet

3. Is the site readily accessible? X Yes        No

If No, explain. \_\_\_\_\_

4 For each pair of descriptors, circle the one that best describes the site.

Wooded/open

hilly/flat

marshy/dry

Other \_\_\_\_\_

5 Does the site contain or drain into surface water? Yes No

Site drains to Lake Hillsboro (to the east) and to a tributary of the Middle Fork Shoal Creek (to the west)

If Yes what type(s)?

Pond or lake: Artificial storm water pond

Location southwest corner of site

Area 1.2 acres

Average Depth (or depth range) unknown



Pond or lake: Artificial storm water pond

Location southeast portion of site

Area 0.27 acres

Average Depth (or depth range) unknown

Pond or lake: Artificial storm water retention basin

Location eastern portion of site (northern pond)

Area 0.41 acres (when full); surface area of water reduced by approx. 20% at time of site visit

Average Depth (or depth range) less than one foot at time of site visit

Pond or lake: Artificial storm water retention basin

Location eastern portion of site (southern pond)

Area 0.41 acres (when full); surface area of water was reduced by approx. half at time of site visit

Average Depth (or depth range) less than one foot at time of site visit

Stream or River (including intermittent streams) There are two intermittent drainage ditches on the site and two intermittent streams located offsite. These serve as storm water conduits from the site.

Onsite – The intermittent drainage ditch that crosses northeast corner of the site and flows eastward was dry at the time of the site visit.

Location Northeast corner of the site

Length (onsite) is 1,344 feet

Average Width (or width range) Dry at time of site visit

Average Depth (or depth range) Dry at time of site visit

Type(s) of bottom Silty clay

Flow Rate Dry at time of site visit

Onsite – The intermittent drainage ditch that drains the southwest portion of the site and flows west was dry at the time of the site visit.

Location Southwest portion of the site

Length (onsite) is 900 feet

Average Width (or width range) Dry at time of site visit

Average Depth (or depth range) Dry at time of site visit

Type(s) of bottom Silty clay

Flow Rate Dry at time of site visit

Offsite – The intermittent stream that begins at the outfall from the stormwater retention basins and ends at Lake Hillsboro.

Location East of the site

Length 2,724 feet

Average Width (or width range) Mostly dry at time of site visit. Channel width averages 4 feet.

Average Depth (or depth range) Mostly dry at time of site visit. Pools of water observed were approximately

10 inches deep on average

Type(s) of bottom Silty clay, some rocks

Flow Rate Not flowing at time of visit. Water was observed in pools. Sediments were firmly dry at location of outlet to Lake Hillsboro.

Offsite – The intermittent stream that begins at the western site boundary, downstream from the southwest pond, and which ends at the unnamed tributary to Middle Fork Shoal Creek

Location West of the site

Length 1,784 feet

Average Width (or width range) Channel width averages 3 feet

Average Depth (or depth range) < 6 inches

Type(s) of bottom Silty clay, some rocks

Flow Rate Very low flow, almost stagnant

Estuary/embayment: Not applicable

Location \_\_\_\_\_

Area \_\_\_\_\_

Average Depth (or depth range) \_\_\_\_\_

Type(s) of bottom \_\_\_\_\_

List any known parameters of site-associated surface water On-site drainageways are ephemeral and were dry at the time of the site visit

PH \_\_\_\_\_ Temperature \_\_\_\_\_ Dissolved Oxygen \_\_\_\_\_

Total Suspended Solids \_\_\_\_\_

Total Organic Carbon \_\_\_\_\_

Hardness \_\_\_\_\_

Salinity \_\_\_\_\_

Other (specify) \_\_\_\_\_

List any known parameters of site-associated surface water: Offsite - The intermittent stream that begins at the outfall from the stormwater retention basins and ends at Lake Hillsboro. Measurements taken from pool of water (stream was mostly dry) ~150 meters downstream of Industrial Drive

PH \_\_\_\_\_ Temperature 21.5 °C Dissolved Oxygen \_\_\_\_\_

Total Suspended Solids \_\_\_\_\_

Total Organic Carbon \_\_\_\_\_

Hardness \_\_\_\_\_

Salinity \_\_\_\_\_

Other (specify) Conductivity 543 µS/cm

## Attachment A

List any known parameters of site-associated surface water: Offsite – The intermittent stream that begins at the western site boundary, downstream from the southwest pond, and which ends at the unnamed tributary to Middle Fork Shoal Creek. Measurements taken just downstream of site

pH \_\_\_\_\_ Temperature 15.8 °C Dissolved Oxygen \_\_\_\_\_

Total Suspended Solids \_\_\_\_\_

Total Organic Carbon \_\_\_\_\_

Hardness \_\_\_\_\_

Salinity \_\_\_\_\_

Other (specify) Conductivity 933 µS/cm, Iron color and some precipitate observed in stream just downstream of the pond. Sedimentation problems apparent, cement tailings from nearby cement facility spilled over the bank and appear to be contributing to sedimentation problems.

List any known sediment parameters of site-associated bodies of surface water.

Sediment type(s)

Grain Size \_\_\_\_\_ pH \_\_\_\_\_ Eh \_\_\_\_\_ pE \_\_\_\_\_

Total Organic Carbon

Acid-Volatile Sulfides

Other (specify):

(If more than one surface water body of each type, repeat information as needed.)

6 Does the site contain or drain into wetlands? X Yes \_\_\_\_\_ No

If Yes, what type(s) and size(s)? According to the National Wetland Inventory (NWI) Map for Hillsboro, Illinois (U.S. Fish and Wildlife Service, 1988), the only mapped wetlands on the site property include the southwest retention pond and the small pond located in the southeast part of the site. These ponds are mapped as "intermittently exposed palustrine wetlands with unconsolidated materials in diked or impounded areas."

List any known surface water and sediment parameters of site wetlands, as in #5, above.

See #5 above (ponds)

7. Describe sub-surface hydrology.

Overlying strata None

Aquifer Unconfined water table aquifer composed of stratified glacial deposits ranging from silty clay to clayey sand

Depth of aquifer Unknown

Location of groundwater discharge Eastern drainageway, western drainageway

## Ecological Description

8. List and describe habitats that occur at the site

Habitats are physically impacted by past, current and anticipated future industrial uses

Woodlands Deciduous woods (see map)

Grasslands/open fields grasslands and open fields (see map)

Wetlands See stormwater pond locations

Ponds Southwest corner of site – retention pond; Southeast corner of site – retention pond,

Northeast corner of site – 2 retention basins

Streams Intermittent drainageways draining northeast and southwest portions of the site Onsite drainageways dry during site visit

Estuaries N/A

Coastal zones N/A

Flood plains N/A

Other natural areas N/A

List any known soil and sediment parameters for each terrestrial habitat

Soil type(s)

Grain Size \_\_\_\_\_ pH \_\_\_\_\_ Eh \_\_\_\_\_ pE \_\_\_\_\_

Total Organic Carbon

Total Phosphorus

Nitrogen forms

Other

9. Are any Federally or State listed endangered or threatened species known or suspected to occur on or near the site?

\_\_\_\_\_ Yes   X   No

Site visit and database search indicated no threatened or endangered species on or near the site (see attached correspondence)

If yes, list

- 10 Does the site have any game species or species of interest for another reason?   X   Yes \_\_\_\_\_ No

If yes, list

Deer tracks observed, common in area

## Known Ecological Effects

11 Does the site show any evidence of adverse ecological effects? ☒ Yes \_\_\_\_\_ No

If yes, list:

Intensive land use during past industrial activities has resulted in physical disturbances to habitats and resultant adverse ecological effects. Manufacturing areas and waste pile areas were cleared of trees, and soils were disturbed for industrial use, resulting in loss of habitat and surface runoff. Some adverse impacts were observed on some remaining trees; dead trees in northern part of site may be due to poor drainage. Sedimentation of nearfield offsite drainageways in the SW drainage has suppressed benthic life. Contributions to sedimentation from a nearby cement plant were apparent. Nearby reference sites had freshwater mussels and clams not observed in this area.

12 Documentation attached:

☒ Site Map

☒ Species List

☒ Threatened and Endangered Species Correspondence

# Attachment A



**Species observed during July 15, 2002 site visit  
Eagle Zinc Company Site**

Dragonfly  
Damselfly  
Turtles, including Eastern Box Turtle  
Green sunfish  
Fathead minnow  
Common shiner  
Green heron  
Songbirds  
Whitetail deer  
Raccoon tracks  
Deer tracks  
Frog  
Crayfish

Nettles  
Cottonwood  
Willow  
Locust  
Phragmites (common reed)  
Pondweed  
Carex (sedge)

-----Original Message-----

**From:** TARA KIENINGER [mailto:TKIENINGER@dnrmail.state.il.us]  
**Sent:** Monday, October 20, 2003 2:37 PM  
**To:** Penelope Moskus  
**Subject:** Re: Request for threatened and endangered species search

October 20, 2003

Penelope Moskus  
Limno-Tech, Inc.  
501 Avis Drive  
Ann Arbor, MI 48108

Dear Ms. Moskus:

I have reviewed the information you provided via email today regarding the Eagle Zinc Company Site near Hillsboro, Illinois. According to the Illinois Natural Heritage Database, there are no endangered or threatened species within the site area you indicated, specifically Township 8 North, Range 4 West, Sections 1 & 12, Third Principal Meridian. Nor are there any listed species within 1 mile of the project site boundaries.

Please be aware that the Natural Heritage Database cannot provide a conclusive statement on the presence, absence, or condition of significant natural features in Illinois. The Department of Natural Resources and the Illinois Nature Preserves Commission can only summarize the existing information known to us at the time of the request. This report should not be regarded as a final statement on the area being considered, nor should it substitute for field surveys required for environmental assessments.

This letter is separate from the Illinois Department of Natural Resources consultation requirement under the Illinois Endangered Species Act (530 ILCS 10/11) and the Illinois Natural Areas Preservation Act (525 ILCS 30/17). For more information on this process, please contact the Illinois Department of Natural Resources, Division of Resource Review and Coordination, at One Natural Resources Way, Springfield, Illinois 62702-1271 or by telephone at (217)785-5500.

Tara Gibbs Kieninger, Database Administrator  
Illinois Natural Heritage Database  
Illinois Department of Natural Resources  
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## Conceptual Model for Eagle Zinc Company Site

